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BOLT WITH SELF-LOCKING ENERGY STORAGE DEVICE

FIELD OF THE INVENTION

The present invention is related to the field of mechanical fastening means, and referred to a bolt with a self-locking energy storage device allowed for preventing looseness.

BACKGROUND

In the field of mechanical industry, the bolt is a basic fittings and connecting means. It is well known that the usage quantity and application field of the bolt is so large, such that the quality and performance thereof is paid attention to over a long period of time. The possibility of frequent looseness and detachment of the bolt, used as coupling basis, may emerges, due to the working environment of high-speed operation and intense vibration to which the mechanical apparatus is subject. With over a hundred years of experience, it has been proven that the additional fittings, such as spring washer, double nut, open lock, anti-withdrawal plate, as examples, frequently used for preventing looseness and detachment in the past, is incapable of meeting the need in practical use. It has been verified that under a long-period alternating loading or impact loading, the bolt, even fastened well, may lose pretension owing to the elongated deformation, fatigue collapse of the thread, leading to clearance and looseness. Then, the spring washer and the double nut may thus lose efficacy. Therefore, it would be desirable to find a novel bolt with higher reliability and safety in order to enhance the quality and performance of the mechanical coupling.

SUMMARY OF THE INVENTION

It is the object of the present invention to provide a bolt with self-locking energy storage device capable of both avoiding the looseness of bolt by itself and releasing stored energy simultaneously when wear or deformation of the bolt arises, by means of a fastening means allowed for self-locking and mutual locking with respect to a screw nut and a screw rod, as well as storing and releasing mechanical energy, in order for releasing the stored energy simultaneously to prohibit looseness.

For the purpose of achieving the aforementioned object, technical schemes described below are adopted in the present invention.

In the present invention, an engagement relation between a thread and a spiral of spring is used to compose a spiral self-locking and energy storage means, comprising a screw rod including two parts of an inner locking spring and an outer torsional spring, and an energy storage spring, a nut cap, and a lower nut cap engaged

with the screw rod, as well as an upper locking spring, a middle locking spring, and a lower locking spring engaged therewith, respectively; among all of which, direct engagement relation is presented. Moreover, a snap head used for prohibiting looseness is further provided at the bottom of the screw rod. A system with self-locking, mutual locking, and inter-locking, allowed for being tightly rotated only and incapable of being reversed, is constituted by these components, such that once the loss of fastening force resulted from wear, fatigue, plastic deformation arises, automatic fastening provided by forward rotation is obtained simultaneously by the use of stored mechanical energy in order to offset the present clearance.

The structure of the bolt with self-locking energy storage device according to the present invention is described as follows:

The bolt with self-locking energy storage device of the present invention comprises a screw rod and a nut cap, characterized in that the inner wall of the nut cap is engaged with an upper locking spring; the bottom end portion of the nut cap is provided with a lateral unlocking hole, and the top end face thereof is provided with a fixing groove, one end of the upper locking spring being snapped in the fixing groove, while the other end thereof being inserted into the unlocking hole.

The characteristic of the bolt is that the screw rod includes two portions with different diameters, a nearly lower portion thereof having a smaller diameter being engaged with a lower locking spring, in which threads of these two portions may be formed as a unified spiral after assembled.

The characteristic of the bolt is that the nut cap further comprises a lower nut cap having a thread the same as that of the nut cap, the lower nut cap and the nut cap being coupled as an unit, the inner wall of the lower nut cap being engaged with a middle locking spring.

The characteristic of the bolt is that at the outer diameter of the screw rod, there is engaged with an energy storage spring having an inner locking spring with self-locking effect and an outer torsional spring with thrust effect.

The characteristic of the bolt is that the bottom end portion of the portion of bolt having the larger diameter is provided with an unlocking groove, and the portion of bolt having the smaller diameter is engaged with the lower locking spring, a fixed end of the lower locking spring being hooked in the fixing groove at the bottom end portion of the screw rod, while a free end thereof being inserted into the unlocking groove of the screw rod.

The characteristic of the bolt is that the inner wall of the nut cap is divided into upper and lower sections with different inner diameters, the upper section with a smaller inner diameter being engaged with the upper locking spring, while the lower section with a larger inner diameter being fitted with the outer wall of the lower nut

cap, in which the top end face of the nut cap is further provided with a blind hole into which the end portion of the energy storage spring is inserted.

The characteristic of the bolt is that the lower nut cap is presented as a hat-like body having an inner thread, the inner thread thereof being engaged with that of the middle locking spring, the outer wall thereof being fitted with the nut cap, the top end face thereof being provided with a fixing groove, the flat brim thereof being provided an unlocking hole.

The characteristic of the bolt is that one end of the middle locking spring is provided with a thicker fixed end, snapped in the fixing groove of the lower nut cap, and a free end of the middle locking spring is inserted into the unlocking hole of the lower nut cap.

The characteristic of the bolt is that at the center of the bottom end face of the screw rod, there is provided with a recess hole into which a snap head is inserted, the fixing groove at the bottom end of the screw rod being disposed on the snap head.

The characteristic of the bolt is that the snap head is presented as "⊥" shape, the top end thereof being provided with a projecting post fitted with the recess hole at the end portion of the screw rod, while the bottom face thereof being provided with a fixing groove used for the installation of the lower locking spring.

The characteristic of the bolt is that the fitting connection between the nut cap and the lower nut cap: the lower section of the inner wall of the nut cap having a thread with a smaller thread pitch, while the outer wall of the lower nut cap having a thread engaged with the thread of the nut cap.

The characteristic of the bolt is that the fitting connection between the nut cap and the lower nut cap: the cross section of the inner wall at the lower section of the nut cap is presented as hexagon, while the cross section of the outer wall at the upper section of the lower nut cap is presented as hexagon fitted with the former.

Another bolt with self-locking energy storage device of the present invention comprises a screw rod and a nut cap, characterized in that the screw rod includes two portions with different diameters, a nearly lower portion thereof having a smaller diameter being engaged with a lower locking spring, in which threads of these two portions may be formed as an unified spiral, after the lower locking spring is assembled.

Still another bolt with self-locking energy storage device of the present invention comprises a screw rod and a nut cap, characterized in that further comprises an energy storage spring engaged with the outer diameter of the screw rod, the energy storage spring including an inner locking spring with self-locking effect and an outer torsional spring with thrust effect, the top end face of the nut cap being provided with a blind hole into which the end portion of the outer torsional spring is inserted.

BRIEF DESCRIPTION OF DRAWINGS

Fig. 1a is a cross section view of an assembled bolt with self-locking energy storage device according to one embodiment of the present invention;

Fig. 2 is a diagram of a screw rod shown in Fig. 1;

Fig. 3 is a diagram of an energy storage spring shown in Fig. 1;

Fig. 4 is a perspective view of an upper nut cap shown in Fig. 1;

Fig. 5 is a longitudinal cross section view of the upper nut cap shown in Fig. 4;

Fig. 6 is a perspective view of a lower nut cap shown in Fig. 1;

Fig. 7 is a diagram of a snap head at the end of the screw rod shown in Fig. 1;

Fig. 8 is a top view of the snap head shown in Fig. 7; and

Figs. 9a, 9b and 9c are diagrams of an upper locking spring, a middle locking spring, and a lower locking spring, respectively, shown in Fig. 1.

DETAILED DESCRIPTION

The feature of the present invention is further described below in company with the attached drawings and embodiments:

A bolt with a self-locking energy storage device, as shown in Fig. 1, comprises a screw rod 1, a lower locking spring 7, an upper locking spring 5, a middle locking spring 6, a lower nut cap 4, a nut cap 3, an energy storage spring 2, and a snap head 8. The lower spring 7 is disposed at the nearly lower end of the screw rod 1, and the lowest end of the screw rod 1 is fixed with the snap head 8. The upper locking spring 5 and the middle locking spring 6 are threadedly fixed at the middle top end of the fixing nut of the screw rod 1, while the exteriors of the upper locking spring 5 and the middle locking spring 6 are threadedly connected to the lower nut cap 4 and the nut cap 3. The top end of the nut cap 3 is fixed with the energy storage spring 2.

As illustrated in Fig. 2, there is shown a diagram of the screw rod 1 illustrated in Fig. 1. In this embodiment, a threaded portion of the screw rod 1 is divided into two sections with different diameters, in which the diameter of a nearly lower section of the screw rod 1 is smaller, while that of an upper section thereof is larger. Standard or non-standard threads may be used for a threaded portion with smaller diameter 13 and a threaded portion with larger diameter 11. At the end of the portion with larger diameter, there is provided with an unlocking groove 12; while at the center of the bottom surface of the screw rod 1, there is provided with a hexagonal or square recess hole 14. The threaded portion 13 is used for engaging with the lower locking spring 7, and the unlocking groove 12 is used for fixing a free end 72 of the lower locking spring 7 (as shown in Figs. 1 and 9c). The recess hole 14 is used for fixing the snap head 8. The spiral formed by the engagement of the non-standard

threaded portion 13 with the lower locking spring 7 should be consistent with the spiral of the standard thread on the upper portion of the screw rod 1.

As shown in Fig. 3, the energy storage spring 2 included in the bolt of the present invention may be divided into an inner locking spring 21 and an outer torsional spring 22. The end portion of the inner locking spring 21 of the energy storage device 2 is a free end 23. The end head of the outer torsional spring 22 is an outer hook 24 inserted into a blind hole of the nut cap 3 in use. With a continuous twist in use, the spacing of the outer torsional spring may be diminished gradually, and finally allowed to wrap around the inner locking spring. The self-locking effect is provided for the inner locking spring 21, while the thrust effect, as well as the effect of anti-withdrawal, energy storage, and energy releasing are provided for the outer torsional spring 22. Both of the elastic thrust and forward torque of the energy storage spring 2 are capable of rotating these inner locking spring and outer torsional spring in the forward fastening direction.

As illustrated in Figs. 4, and 5, there are shown, in Fig. 4, a perspective view of the nut cap 3 illustrated in Fig. 1, and, in Fig. 5, a longitudinal cross section view of the nut cap 3 illustrated in Fig. 4. The inner thread of the nut cap 3 provided according to this embodiment is divided into two sections with different inner diameters, i.e., a standard thread with smaller inner diameter 33 and a thread with larger inner diameter 34, in which the thread pitch of the latter is smaller than that of the standard thread. At the connection end of the standard thread 33 with the reverse thread 34, there is provided with a lateral unlocking hole 32. On the upper end face of the nut cap 3, a blind hole 31 and a fixing groove with larger end portion 35 are provided. The standard thread 33 is engaged with the upper locking spring 5 in use. The blind hole 31 is inserted with the outer hook 24 of the energy storage spring 2.

As illustrated in Fig. 6, there is shown a perspective view of the lower nut cap 4 illustrated in Fig. 1. The lower nut cap 4 is a hat-like body with inner and outer threads. In this embodiment, the inner thread is presented as a standard thread 42, while the outer thread is presented as a reverse thread 41 with smaller thread pitch. The upper end face of the lower nut cap 4 is provided with a fixing groove 44, while a flat brim of hat of the lower nut cap 4 is provided with an unlocking hole 43 thereon. The lower nut cap 4 is engaged with the nut cap 3 by means of the thread with smaller thread pitch 41 and the reverse thread 34, respectively. The standard thread 42 is engaged with the middle locking spring 6.

As illustrated in Figs. 7 and 8, there are shown diagrams of the snap head 8 fixed at the end of the screw rod 1 in the bolt illustrated in Fig. 1. In the present invention, the snap head 8 is provided with a projecting post 81 fitted with the recess hole 14 disposed at the end of the screw rod 1, and a fixing groove 82 used for the

installation of the lower locking spring.

As illustrated in Fig. 9, there are shown the upper locking spring 5, the middle locking spring 6, and the lower locking spring 7 in Figs. 9a, 9b, and 9c, respectively. In this embodiment, inner diameters of the upper locking spring 5 and the middle locking spring 6 are both a little less than the minor diameter of the screw rod 1 with which these two springs are engaged, in which the difference between these two diameters may be about 1/2 thread pitch. Moreover, the outer diameter of the lower locking spring 7 is a little larger than the major diameter of the screw rod 1 with which this spring is engaged, in which the difference between these two diameters may be about 1/2 thread pitch. One end of the upper locking spring 5 and that of the middle locking spring 6 are provided with wider fixed ends 51, 61, respectively, these two fixed ends being snapped into the fixing groove 35 of the nut cap 3 and the fixing groove 44 of the nut cap 4, correspondingly. The other end of the upper locking spring 5 and that of the middle locking spring 6 are free ends 52 and 62, respectively. When assembling, the upper locking spring 5 and the middle locking spring 6 are engaged with the nut cap 3 and the lower nut cap 4, respectively, and the free ends of the former are then disposed at the unlocking hole 32 of the nut cap 3 and the unlocking hole 43 of the lower nut cap 4, correspondingly. Subsequently, a fixed end of the lower locking spring 7 is hooked in the fixing groove 82 of the snap head 8, while a free end thereof is situated in the unlocking groove 12 of the screw rod 1.

The cross sections of numerous springs used in the bolt of the present invention may be presented as various geometric shapes, such as circle, ellipse, diamond, rectangle, and triangle, as examples. In this embodiment, the cross sections of the springs are presented as diamond.

The recess hole 14 at the center of the bottom end face of the screw rod 1 in this embodiment is presented as either hexagonal or square, while the corresponding projecting post 81 on the snap head 8 is also presented as either hexagonal or square, in order to prevent the relative rotation between the screw rod 1 and the snap head 8. In this embodiment, the cross sections of the recess hole 14 and the projecting post 81 are presented as hexagon.

In this embodiment, the coupling between the nut caps 3 and 4 may be achieved by not only the thread, but also the clasping connection used with hexagonal holes. The integrally fitting relation is used for just allowing the relative forward rotation, but incapable of being reversed, between the screw rod and the nut caps, no matter what kind of fitting is adopted.

The effects of the present invention include as follows:

The bolt with self-locking energy storage device of the present invention is designed by adequately embodying the resilience feature of spring and the effect of

friction force as well as utilizing the direct or indirect engagement between the thread and coil spring, while allowed for integrating the energy storage, self-locking, mutual locking, inter-locking, and automatic pretension means into one unit. Each part in this device may be individually allowed for unidirectional self-locking. Owing to the mutual locking between the energy storage spring and the screw rod, mutual locking between the screw rod and the screw hole, mutual locking between the energy storage spring and the screw nut, mutual locking between the screw nut and the screw rod, as well as the self-locking of the screw nut itself, relative rotation may be still possible under the effect of the stored mechanical energy, while the reverse rotation may be prohibited. That is, all of the coupling portions are allowed to be rotated tightly, while incapable of being reversed.

This device comprises several advantages, for instance: an appropriately compact structure, the omission of the additional fittings, such as double nut, piercing open lock, spring washer, flat washer, steel wire clack, and anti-withdrawal plate, as examples, and the assembling process therefor; and particularly, a prolonged service life and an enhanced safety together with reliability, significant damage prevention, standardized and systemized production.

It is convenient for disassembling the machine, due to the unlocking hole and unlocking groove provided in the device of the present invention. When disassembling, firstly, the outer hook 24 of the energy storage spring is picked from the blind hole 31. After the energy is released, the energy storage spring 2 is withdrawn by the reverse rotation against the end 23 of the inner spring. Subsequently, an aluminum rivet or other soft metallic wire is inserted into the unlocking hole 32, and pushed against the free end 52 or 62 by the hammer and nail. In this case, the self-locking state of the nut cap 3 and the lower nut cap 4 is relieved, such that these two nut caps may be wrenched off as the common screw nut. The mechanical principle is that oppressing the free end, and directing the external force to the fixing end and against the resistance applied by the fixing end, in such a way that the inner diameter of the self-locking spring is enlarged, and the friction is eliminated correspondingly. Secondly, the whole bolt is disassembled by means of the forced reverse rotation provided by the wrench, such that the snap head 8 at the bottom of the screw rod 1 may be destroyed. As such, the bolt may be disassembled as a whole, and only the replacement of the snap head 8 is required for the next assembly. The mechanical principle is that the self-locking and mutual locking forces applied by the energy storage spring, upper nut cap, and lower nut cap at the upper portion of the screw rod are extremely large, while the diameter of the hexagonal head 81 at the fitting connection between the snap head 8 and the screw rod 1 is thinner, so as to be possibly wrenched out by mighty force, resulting in deformation or break. The lower

locking spring of the screw rod may be taken out, such that renewed installation is allowed if the snap head is replaced.

The primary parts of the aforementioned device may be either totally utilized, or partly or individually used with the common standard screw rod or screw hole depending on the requirement. Base on the practical requirement, the unlocking hole may be not necessary, and the direct connection at the open groove on the bottom of the screw rod may be also used, instead of the snap head, for the fixing between the lower locking spring and the screw rod. It is still possible for the energy storage spring to be used with the common standard bolt individually and directly in replace of the fittings, such as open lock, for example.

The bolt with self-locking energy storage device is mainly designed so as to be cooperated with the current common standard screw rod or screw hole based on international standards, without the need for changing cooperative parts, resulting in superior interchangeability and generalization, as well as more excellent practicability.

LIST OF REFERENCE SYMBOLS

1	bolt
2	energy storage spring
3	nut cap
4	lower nut cap
5	upper locking spring
6	middle locking spring
7	lower locking spring
8	snap head
11, 33, 42	standard thread
12	unlocking groove
13	non-standard thread
14	recess hole
21	inner locking spring
22	outer torsional spring
23	free end
24	outer hook
31	blind hole
35	fixing groove
41	reverse thread
43	unlocking hole
51, 61, 71	fixed end

81	projecting post
82	fixing groove

CLAIMS

1. A bolt with self-locking energy storage device comprising a screw rod and a nut cap, wherein the inner wall of said nut cap is engaged with an upper locking spring; the bottom end portion of said nut cap is provided with a lateral unlocking hole, and the top end face thereof is provided with a fixing groove, one end of said upper locking spring being snapped in said fixing groove, while the other end thereof being inserted into said unlocking hole.

2. The bolt according to Claim 1, wherein said screw rod includes two portions with different diameters, a nearly lower portion thereof having a smaller diameter being engaged with a lower locking spring, the bottom end portion of a portion having a larger diameter being provided with an unlocking groove; the bottom end portion of said screw rod being provided with a fixing groove into which one end of said lower locking spring is hooked, and the other end thereof being a free end inserted in said unlocking groove of said screw rod, in which threads of said two portions are formed as a unified spiral after said lower locking spring is assembled.

3. The bolt according to Claim 2, wherein said nut cap further comprises a lower nut cap having a thread the same as that of the nut cap, said lower nut cap and said nut cap being coupled as an unit, the inner wall of said lower nut cap being engaged with a middle locking spring.

4. The bolt according to Claim 3, wherein at the outer diameter of said screw rod, there is engaged with an energy storage spring having an inner locking spring with self-locking effect and an outer torsional spring with thrust effect.

5. The bolt according to Claim 3, wherein the inner wall of said nut cap is divided into upper and lower sections with different inner diameters, said upper section with a smaller inner diameter being engaged with said upper locking spring, while said lower section with a larger inner diameter being fitted with the outer wall of said lower nut cap, in which the top end face of said nut cap is further provided with a blind hole into which the end portion of said energy storage spring is inserted.

6. The bolt according to Claim 3, wherein said lower nut cap is presented as a hat-like body having an inner thread, said inner thread thereof being engaged with that of said middle locking spring, the outer wall thereof being fitted with said nut cap, the top end face thereof being provided with a fixing groove, the flat brim thereof being provided an unlocking hole.

7. The bolt according to Claim 3, wherein one end of said middle locking spring is provided with a thicker fixed end, snapped in said fixing groove of said lower nut cap, and a free end of said middle locking spring is inserted into said unlocking hole of said lower nut cap.

8. The bolt according to Claim 2, wherein at the center of the bottom end face of said

screw rod, there is provided with a recess hole into which a snap head is inserted, said fixing groove at the bottom end of said screw rod being disposed on said snap head.

9. The bolt according to Claim 8, wherein said snap head is presented as "⊥" shape, the top end thereof being provided with a projecting post fitted with said recess hole at the end portion of said screw rod, while the bottom face thereof being provided with a fixing groove used for the installation of said lower locking spring.

10. The bolt according to Claim 6, wherein the fitting connection between said nut cap and said lower nut cap: said lower section of the inner wall of said nut cap having a thread with a smaller thread pitch, while the outer wall of said lower nut cap having a thread engaged with said thread of said nut cap.

11. The bolt according to Claim 6, wherein the fitting connection between said nut cap and said lower nut cap: the cross section of the inner wall at said lower section of said nut cap is presented as hexagon, while the cross section of the outer wall at said upper section of said lower nut cap is presented as hexagon fitted with the former.

12. A bolt with self-locking energy storage device comprising a screw rod and a nut cap, wherein said screw rod includes two portions with different diameters, a nearly lower portion thereof having a smaller diameter being engaged with a lower locking spring, in which threads of said two portions are formed as an unified spiral after said lower locking spring is assembled.

13. A bolt with self-locking energy storage device comprising a screw rod and a nut cap, further comprising an energy storage spring engaged with the outer diameter of said screw rod, said energy storage spring including an inner locking spring with self-locking effect and an outer torsional spring with thrust effect, the top end face of said nut cap being provided with a blind hole into which the end portion of said outer torsional spring is inserted.

ABSTRACT

There is disclosed a bolt with self-locking energy storage device comprising a screw rod, and an energy storage spring, an upper locking spring, a middle locking spring, a lower locking spring engaged with the screw rod directly, as well as an upper nut cap, a lower nut cap engaged with the screw rod indirectly. The bottom portion of the screw rod is further provided with a snap head used for preventing the looseness of the bolt. The lower locking spring is allowed for wrapping around the nearly lower end of the screw rod. The exteriors of the upper locking spring and the middle locking spring are threadedly connected to the upper nut cap and the lower nut cap, respectively. The top end of the upper nut cap is fixed with the energy storage spring. The nearly lower end of the screw rod is provide with a non-standard thread engaged with the lower locking spring, and the nearly upper end thereof is provided with a standard thread. At the center of the bottom end face of the screw rod, there is provided with a recess hole used for fixing the snap head. This device is allowed for not only avoiding looseness and detachment of the bolt, but also releasing the stored energy simultaneously once the loss of fastening force resulted from wear, fatigue, deformation arises

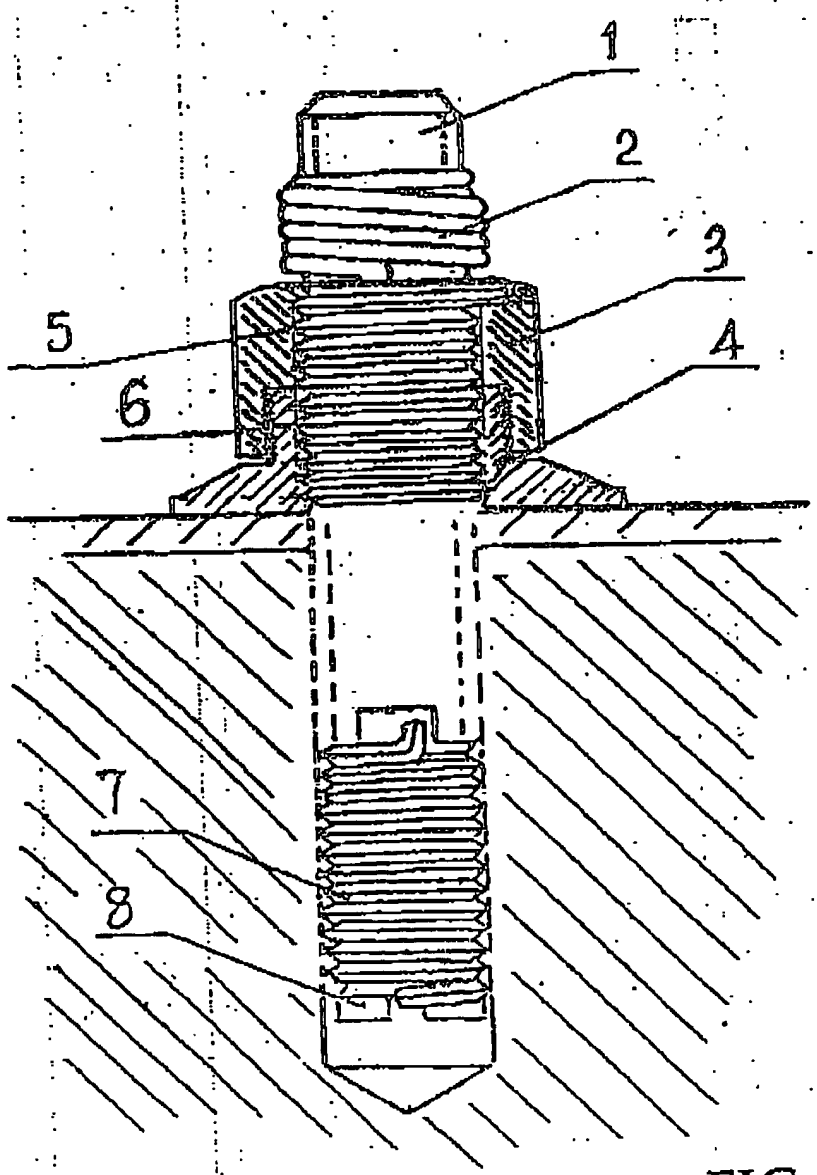


FIG. 1

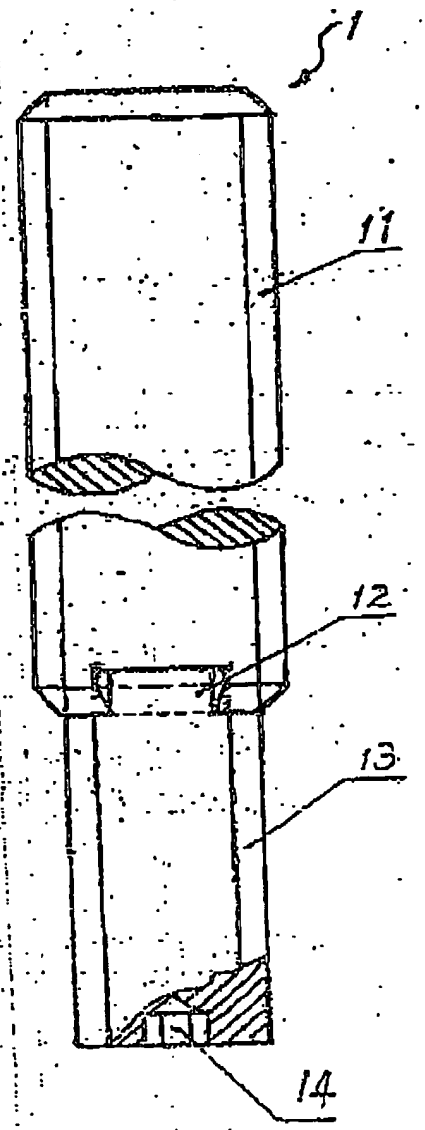
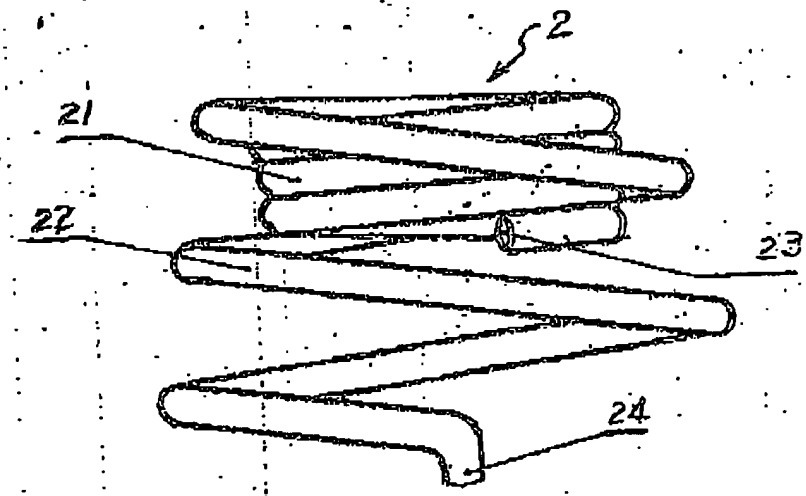


FIG. 2



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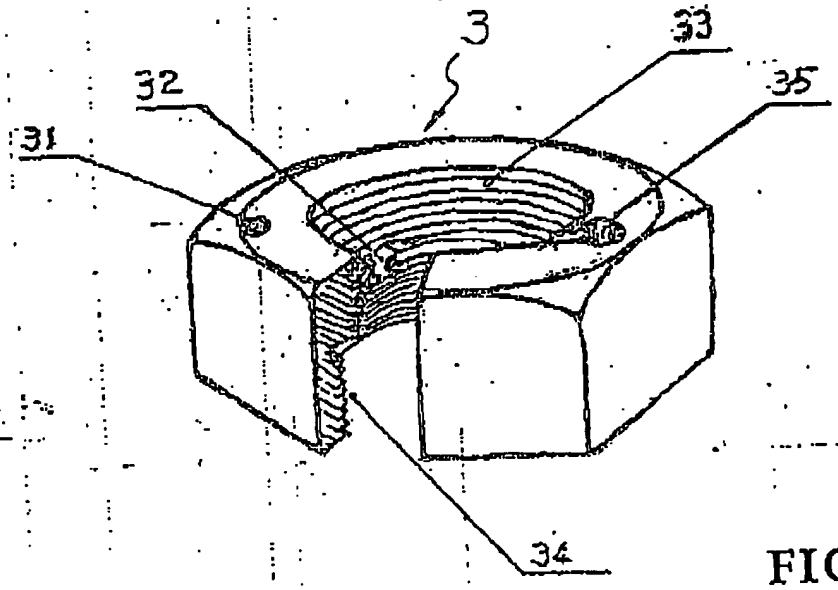

FIG. 4

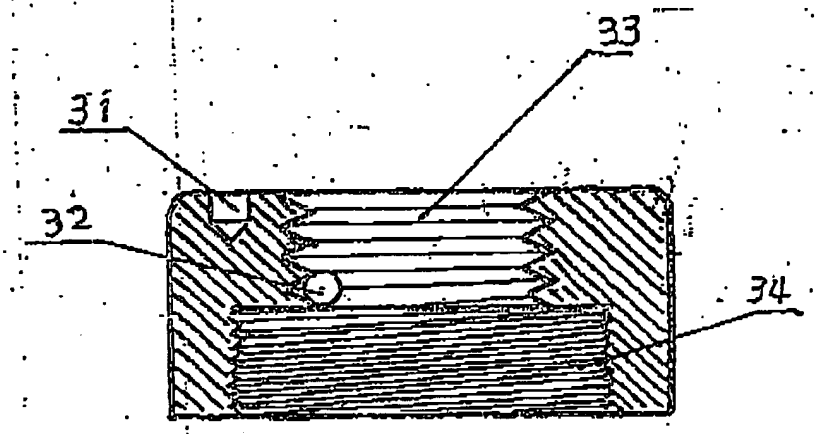

FIG. 5

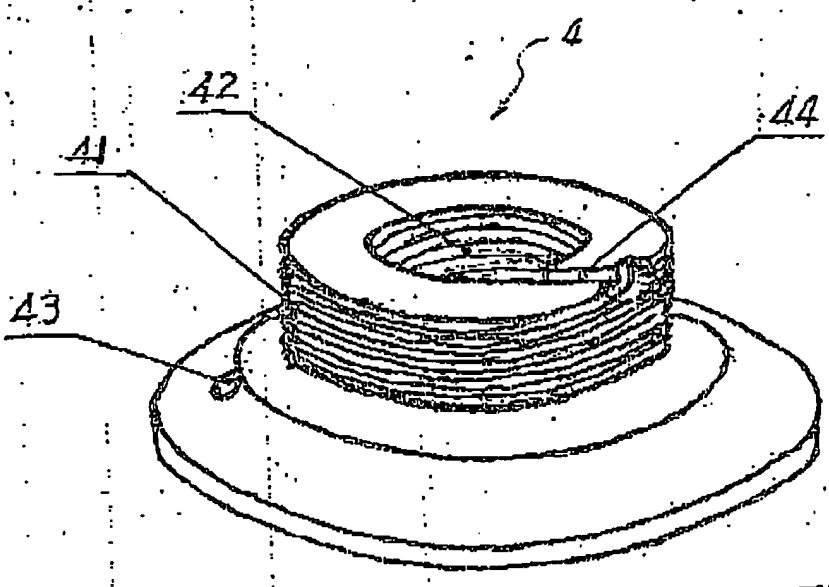

FIG. 6

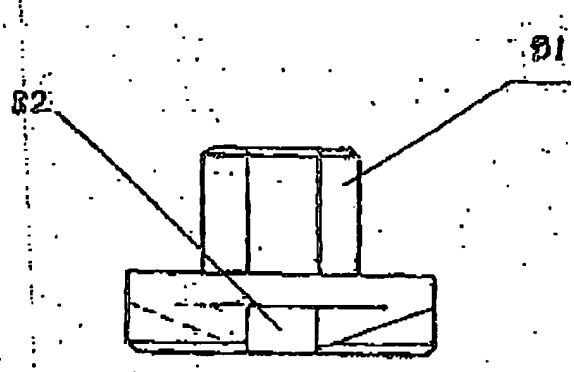

FIG. 7

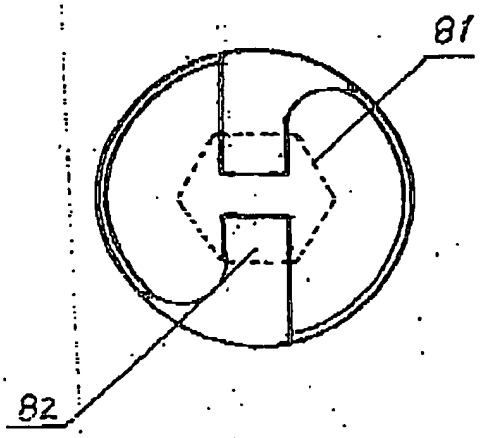

FIG. 8

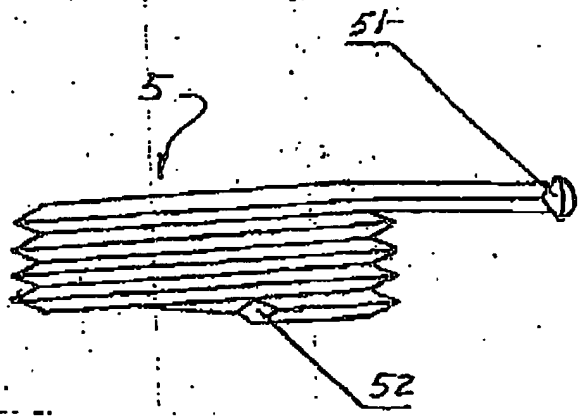

FIG. 9a

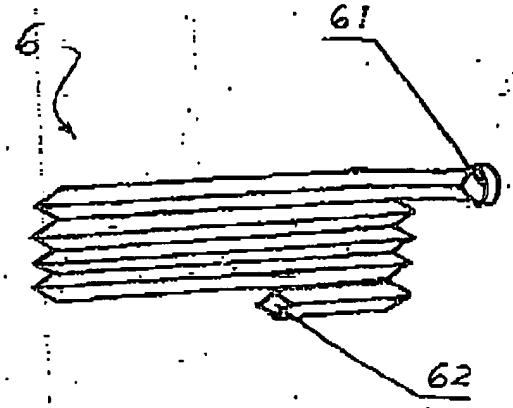

FIG. 9b

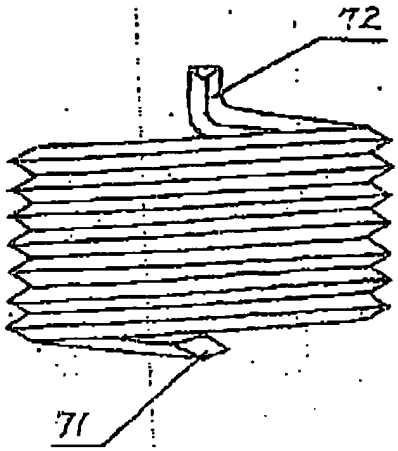

FIG. 9c

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一、發明~~新型~~名稱	中文	帶自鎖儲能裝置的螺栓
	英文	
二、發明~~創作~~人	姓名	嚴明
	國籍	中國
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四、中文發明摘要（發明之名稱：帶自鎖儲能裝置的螺栓

一種帶自鎖儲能裝置的螺栓，包括螺桿、直接嚙合於螺桿的儲能簧、上鎖簧、中鎖簧及下鎖簧，間接嚙合於螺桿的上螺母、下螺母；螺桿底部還設有防止螺桿鬆動的卡頭；下鎖簧繞在螺桿的靠下端；在上鎖簧及中鎖簧的外部分別螺接上螺母及下螺母，上螺母的上端固定儲能簧；螺桿的靠下端設有與下鎖簧嚙合的非標準螺紋，近上端設有標準螺紋，螺桿底端面中心處設有固定卡頭的凹孔。本裝置既避免螺栓鬆動脫落又能在當螺栓發生磨損、疲勞、變形而使預緊力喪失時，能及時將儲能施放。

英文發明摘要（發明之名稱：

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（由本局填寫）

承辦人代碼：
大　　類：
IPC分類：

本案已向：

中國大陸（地區） 申請專利，申請日期：1996,04,10 案號：96103391.6 ，□有 ☑無主張優先權

有關微生物已寄存於： ，寄存日期： ，寄存號碼：

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五、發明說明（ 1）

本發明屬於機械緊固構件領域，涉及一種可防鬆動的帶自鎖儲能裝置的螺栓。

背景技術

在機械工業領域內，螺栓是基礎配件和連接件，其用量之大，範圍之廣是人所皆知的，它的質量性能，一直為人們所關注。機械設備常處於高速運轉與強烈震動的工作環境，作為聯結基礎的螺栓，會經常出現鬆動與脫落的可能。過去，人們為防止鬆動脫落，常常採用的彈簧墊圈、對頂螺帽、開口銷、止退片等附加配件，經上百年的使用證明，已經不能滿足實際使用的需要。事實證明，在長時間受交變載荷，衝擊載荷作用下，緊固再好的螺栓也會被拉長變形，螺紋會疲勞傾倒而使預緊力喪失，導致產生緊固間隙及出現鬆動現象，以至彈簧墊圈、對頂螺帽都會失去作用；為此，人們致力於尋求一種更可靠，更安全的新型緊固螺栓，以提高機械聯結件的質量與性能。

發明內容

本發明的目的在於提供一種可自行避免螺栓鬆動又能在螺栓發生磨損、變形時，及時釋放儲能的帶自鎖儲能裝置的螺栓，其是利用螺帽、螺桿自鎖、互鎖以及可儲備與釋放機械能的緊固機構，及時釋放儲能的阻止鬆動。

為達到上述目的，本發明採取下述技術方案：

本發明是利用螺紋與彈簧螺旋之間的嗤合關係，組成螺旋自鎖及儲能機構，它包含發生直接嗤合關係的螺桿

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五、發明說明（ 2）

簧、螺母、下螺母以及和它們之間發生嗤合關係的上鎖簧、中鎖簧、下鎖簧，螺桿的底部還設有制止鬆動的卡頭；由這些部件組成一種只能擰緊不能倒旋的自鎖、互鎖、聯鎖的體系，一旦發生因磨損、疲勞、塑性變形而出現緊固力喪失時，可利用儲備的機械能及時正旋自動緊固，彌補出現的間隙。

本發明的帶自鎖儲能裝置的螺栓結構如下：

本發明的帶自鎖儲能裝置的螺栓，包括螺桿及螺母，其特徵在於，螺母內壁嗤合有一上鎖簧；螺母的下端部設有一個橫向解鎖孔，上端面設有一個固定槽，上鎖簧的一端卡設在固定槽中，另一端插在解鎖孔中。

所述的螺栓，其特徵在於，所述螺桿形成直徑不同的兩部分，螺桿靠下端部分的直徑較小，直徑較小部分嗤合有一下鎖簧，組裝後，該兩部分的螺紋形成統一的螺旋線。

所述的螺栓，其特徵在於，所述螺母還包含一個與其具有相同內螺紋的下螺母，下螺母與螺母結合為一體，下螺母內壁嗤合有一中鎖簧。

所述的螺栓，其特徵在於，所述螺桿外徑上嗤合有一儲能簧，儲能簧中包含具有自鎖作用的內鎖簧及具有推力作用的外扭簧。

所述的螺栓，其特徵在於，所述螺桿的直徑較大部分的下端部設有一解鎖槽；所述直徑較小部分與所述下鎖簧相嗤合，下鎖簧的固定端鈎掛在螺桿的下端部的固定槽

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五、發明說明（ 3 ）

所述的螺栓，其特徵在於，所述螺母內壁分為內徑不同的上、下兩段，內徑較小的上段與所述上鎖簧相嗑合，內徑較大的下段與所述下螺母外壁配合連接，螺母的上端面還設有一個用於插植所述儲能簧端部的盲孔。

所述的螺栓，其特徵在於，所述下螺母為帶有內螺紋的帽狀體，其內螺紋設有與所述中鎖簧相嗑合的螺紋，其外壁與所述螺母配合連接，下螺母的上端面設有固定槽，下螺母的扁狀帽邊上設有一解鎖孔。

所述的螺栓，其特徵在於，所述中鎖簧的一端設有較粗的固定端，其卡設在所述下螺母的固定槽中，中鎖簧的活動端插在下螺母的解鎖孔中。

所述的螺栓，其特徵在於，所述螺桿的底端面中心處設有一個凹孔，一卡頭插在凹孔處，所述螺桿下端的固定槽位於卡頭上。

所述的螺栓，其特徵在於，所述卡頭呈“凸”字形，上端設有與所述螺桿端部凹孔相配的凸柱，在底面設有安裝下鎖簧用的固定槽。

所述的螺栓，其特徵在於，所述螺母與下螺母的配合連接：螺母內壁下段設有螺距較小的螺紋，所述下螺母的外壁設有與螺母的螺紋嗑合的螺紋。

所述的螺栓，其特徵在於，所述螺母與下螺母的配合連接：螺母下段內壁的橫斷線為六邊形，所述下螺母上段外壁的橫斷線為與螺母內壁下段配合的六邊形。

本發明的另一種帶自鎖儲能裝置的螺栓，包括螺桿

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五、發明說明（ 4）

及螺母，其特徵在於，螺桿形成直徑不同的兩部分，螺桿靠下端部分的直徑較小，直徑較小部分嵌合有一下鎖簧，組裝下鎖簧後，該兩部分的螺紋形成統一的螺旋線，直徑較小部分嵌合有一下鎖簧。

本發明的再一種帶自鎖儲能裝置的螺栓，包括螺桿及螺母，其特徵在於，還包括一嵌合於螺桿外徑上的儲能簧，儲能簧中包含具有自鎖作用的內鎖簧及具有推力作用的外扭簧，螺母的上端面設有一個用於插植外扭簧端部的盲孔。

附圖概述

第1圖：本發明的帶自鎖儲能裝置的螺栓實施例的組合剖視圖；

第2圖：第1圖中螺桿的示意圖；

第3圖：第1圖中儲能簧的示意圖；

第4圖：第1圖中上螺母的立體示意圖；

第5圖：第4圖所示上螺母的縱向剖視圖；

第6圖：第1圖中下螺母的立體圖；

第7圖：第1圖中螺桿端處卡頭的示意圖；

第8圖：第7圖所示卡頭的頂視圖；

第9a、9b、9c圖：分別為第1圖中的上鎖簧、中鎖簧與下鎖簧的示意圖。

本發明的最佳實施方式

下面結合附圖及實施例，進一步說明本發明的特點：

如第1圖所示，本發明的帶自鎖儲能裝置的螺栓包括

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五、發明說明（ 5）

螺桿1、下鎖簧7、上鎖簧5、中鎖簧6、下螺母4、螺母3、儲能簧2及卡頭8；下鎖簧7繞在螺桿1的靠下端，螺桿1的最下端固定有卡頭8；上鎖簧5及中鎖簧6螺固於螺桿1固定螺帽的中上端，在上鎖簧5及中鎖簧6的外部螺接有下螺母4及螺母3，螺母3的上端固定有儲能簧2。

如第2圖所示，其為第1圖中所示螺桿1的示意圖；本實施例中，螺桿1的螺紋部分分為直徑不同的兩段，螺桿1的靠下段直徑較小，上段直徑較大，直徑較小的螺紋部分13及直徑較大的螺紋部分11可採用標準螺紋或非標準螺紋，在直徑較大部分的末端設有一解鎖槽12，螺桿1的底端面中心處設有一呈六角形或方形的凹孔14；所述螺紋部分13用以與下鎖簧7相嚙合，解鎖槽12用於固定下鎖簧7的活動端72(如第1及9c圖所示)；凹孔14用於固定卡頭8，非標準螺紋部分13與下鎖簧7相嚙合後所形成的螺旋線與螺桿1上部的標準螺紋的螺旋線應相一致。

如第3圖所示，本發明的螺栓中所包含的儲能簧2分為內鎖簧21及外扭簧22，儲能簧2的內鎖簧端部21的端部為自由端23，外扭簧22的端頭即外掛鉤24，在使用時插入螺母3的一盲孔中，使用時隨著繼續旋擰使外扭簧間距逐漸縮小，最後將內鎖簧裹住。內鎖簧21具有自鎖作用，外扭簧22具有推力作用，以及具有止退、儲能和施放能量的作用，儲能簧2具有的彈性推力和正旋扭矩都使它們向緊固的正旋方向推旋。

五、發明說明（ 6）

立體示意圖；第5圖為第4圖所示螺母3的縱向剖視圖；本實施例中所設置的螺母3的內螺紋分為內徑不同的兩段，內徑較小的標準螺紋33及內徑較大的螺紋34，且螺紋34的螺距較標準螺紋的螺距小，在標準螺紋33連接反絲螺紋34的端部設有一個橫向的解鎖孔32，螺母3的上端面設有一個盲孔31及一個端部較大的固定槽35；標準螺紋33在使用中與上鎖簧5相嚙合；盲孔31用於插植所述儲能簧2的外掛鉤24。

如第6圖所示，其為第1圖所示的下螺母4的立體圖；下螺母4為一帶有內、外螺紋的帽狀體；本實施例中，其內螺紋為標準螺紋42，外螺紋為螺距較小的反絲螺紋41，下螺母4的上端面設有固定槽44，下螺母4的扁狀帽邊上設有一解鎖孔43；下螺母4以螺距較小的螺紋41與螺母3的反絲螺紋34相嚙合；標準螺紋42與中鎖簧6相嚙合。

如第7、8圖所示，其為第1圖所示的螺栓中固定在螺桿1端處的卡頭8的示意圖；本發明中的卡頭8上設有與螺桿1端部凹孔14相配的凸柱81及安裝下鎖簧用的固定槽82。

如第9圖所示，其中第9a、9b、9c圖分別為第1圖所示的上鎖簧5、中鎖簧6與下鎖簧7的示意圖；本實施例中，上鎖簧5、中鎖簧6的內徑都稍小於與其嚙合的螺桿1的小徑，兩者的差別約為1/2螺距，而下鎖簧7的外徑稍大於與之嚙合的螺桿1的大徑，兩者的差別約為1/2螺距；上鎖簧5及中鎖簧6的一端部分別設有較寬的固定端51、61，它

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五、發明說明（ 7）

們分別卡設在螺母3的固定槽35及下螺母4的固定槽44中，上鎖簧5及中鎖簧6的另一端為活動端52及62；組裝時，上鎖簧5、中鎖簧6分別與螺母3、下螺母4相嚙合後，它們的活動端分別位於螺母3的解鎖孔32和下螺母4的解鎖孔43處；下鎖簧7的固定端71鉤掛在卡頭8中的固定槽82中，活動端72座落在螺桿1的解鎖槽12中。

本發明的螺栓所用的各種彈簧的橫斷面的幾何形狀可以是圓形、橢圓形、菱形、矩形或三角形等各種幾何形狀，本實施例中，彈簧的橫斷面的幾何形狀為菱形。

本實施例中螺桿1的底端面中心處的凹孔14呈六角形也可為方形，與此相應的卡頭8上的凸柱81也呈六角形或方形，以防止螺桿1與卡頭8間的相對轉動，本實施例中的凹孔14與凸柱81的橫斷面為六角形。

本實施例中螺母3與下螺母4間是以螺紋相結合的，也可採取六方孔扣壓式聯接方式，不論採取哪種配合方式，它們的配合關係作為一整體都是只能使螺桿與螺母間可相對正旋前進不能反旋後退。

本發明具有如下效果：

本發明的帶自鎖儲能裝置的螺栓，充分體現彈簧的彈性特徵和摩擦力的作用，以及利用螺紋與螺旋彈簧的直接或間接嚙合而被設計，其是一種集儲能、自鎖、互鎖、聯鎖、自動預緊機構為一體，裝置中的部件各自都有單向自鎖性，儲能簧與螺桿互鎖，螺桿與螺孔互鎖，儲能簧與[illegible]，在儲存的機械能作用

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五、發明說明（ 8）

下都有可能相對正旋轉動而反旋受到制止，各結合部分只能擰緊不能後退。

本裝置結構緊湊合理，免去對頂螺帽、穿心開口鎖、彈簧墊圈、平墊圈、鋼絲辮、止退片等附加配件及裝配工序，尤其使用方便，提高了使用壽命和安全可靠性，具有很強的防破壞作用，可實現標準化、系列化生產。

由於本發明裝置中設置了解鎖孔和解鎖槽，便於機械拆卸，卸時，先用起子將儲能簧的外掛鉤24從盲孔31中挑起，能量釋放後再頂住內簧端23反旋將儲能簧2退出。再將鋁鉚釘或其他軟金屬絲塞入解鎖孔32中並用錘子和釘子將鋁鉚釘頂入壓迫活動端52或62，此時的螺母3、下螺母4的自鎖狀態被解除，可以像普通螺帽一樣擰下來。機理是壓迫活動端，並將外力導向固定端並與固定端的阻力對頂，使自鎖簧的內徑擴大摩擦相對消除。二是整體拆卸，直接用扳手加力反旋，破壞螺桿底部的卡頭8，將螺栓整體卸下，裝配時只須更換卡頭8即可。機理是螺桿上部由儲能簧、上螺母、下螺母的自鎖互鎖力很大而卡頭8與螺桿1的配合處的六方頭81直徑較細，可強力擰出，使其變形扭曲或斷裂，螺桿可把下鎖簧帶出來，將卡頭更換後可重新安裝。

所述裝置的主要部件可以全部使用，也可以根據要求部分或單獨與普通標準螺桿或螺孔配合使用。根據使用要求解鎖孔可以不設置，下鎖簧與螺桿的固定也可以不用卡

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五、發明說明（ 9）

接與普通標準螺栓配合使用以取代開口鎖等配件的可能。

本發明的帶自鎖儲能裝置的螺栓，主要是針對現今國際標準的普通標準螺桿或螺孔配套使用而設計的，無需更改配套機件，具有互換和通用性及較強的實用性。

元件標號對照

1...螺栓
2...儲能簧
3...螺母
4...下螺母
5...上鎖簧
6...中鎖簧
7...下鎖簧
8...卡頭
11,33,42...標準螺紋
12...解鎖槽
13...非標準螺紋
14...凹孔
21...內鎖簧
22...外扭簧
23...自由端
24...外掛鈎
31...盲孔
35...固定槽
41...反絲螺紋
43...解鎖孔
51,61,71...固定端
81...凸柱
82...固定槽

（請先閱讀背面之注意事項再填寫本頁）

裝 訂 線

經濟部中央標準局員工消費合作社

A8
B8
C8
D8

六、申請專利範圍

1. 一種帶自鎖儲能裝置的螺栓，包括螺桿及螺母，其中，螺母內壁嚙合有一上鎖簧；螺母的下端部設有一個橫向解鎖孔，上端面設有一個固定槽，上鎖簧的一端卡設在固定槽中，另一端插在解鎖孔中。

2. 根據申請專利範圍第1項所述的螺栓，其中，所述螺桿形成直徑不同的兩部分，螺桿靠下端部分的直徑較小，直徑較小部分嚙合有一下鎖簧，直徑較大部分的下端部設有一解鎖槽，螺桿的下端部設有一個固定槽；下鎖簧的一端鉤挂在固定槽中，另一活動端插在螺桿的解鎖槽；下鎖簧組裝後，兩部分的螺紋形成統一的螺旋線。

3. 根據申請專利範圍第2項所述的螺栓，其中，所述螺母還包含一個與其具有相同內螺紋的下螺母，下螺母與螺母結合為一體，下螺母內壁嚙合有一中鎖簧。

4. 根據申請專利範圍第3項所述的螺栓，其中，所述螺桿外徑上嚙合有一儲能簧，儲能簧中包含具有自鎖作用的內鎖簧及具有推力作用的外扭簧。

5. 根據申請專利範圍第3項所述的螺栓，其中，所述螺母內壁分為內徑不同的上、下兩段，內徑較小的上段與所述上鎖簧相嚙合，內徑較大的下段與所述下螺母外壁配合連接，螺母的上端面還設有一個用於插植所述儲能簧端部的盲孔。

6. 根據申請專利範圍第3項所述的螺栓，其中，所述下螺[illegible]

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裝 訂 線

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六、申請專利範圍

簧相嗑合的螺紋，其外壁與所述螺母配合連接，下螺母的上端面設有固定槽，下螺母的扁狀帽邊上設有一解鎖孔。

7. 根據申請專利範圍第3項所述的螺栓，其中，所述中鎖簧的一端設有較粗的固定端，其卡設在所述下螺母的固定槽中，中鎖簧的活動端插在下螺母的解鎖孔中。

8. 根據申請專利範圍第2項所述的螺栓，其中，所述螺桿的底端面中心處設有一個凹孔，一卡頭插在凹孔處，所述螺桿下端的固定槽位於卡頭上。

9. 根據申請專利範圍第8項所述的螺栓，其中，所述卡頭呈“凸”字形，上端設有與所述螺桿端部凹孔相配的凸柱，在底面設有安裝下鎖簧用的固定槽。

10. 根據申請專利範圍第6項所述的螺栓，其中，所述螺母與下螺母的配合連接：螺母內壁下段設有螺距較小的螺紋，所述下螺母的外壁設有與螺母的螺紋嗑合的螺紋。

11. 根據申請專利範圍第6項所述的螺栓，其中，所述螺母與下螺母的配合連接：螺母下段內壁的橫斷線為六邊形，所述下螺母上段外壁的橫斷線為與螺母內壁下段配合的六邊形。

12. 一種帶自鎖儲能裝置的螺栓，包括螺桿及螺母，其中，螺桿形成直徑不同的部分，螺桿靠下端部分的直徑較小，直徑較小部分嗑合有一下鎖簧，下鎖簧組裝後其下部分與螺紋形成統一的螺旋線。

（請先閱讀背面之注意事項再填寫本頁）

裝 訂 線

經濟部中央標準局員工消費合作

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六、申請專利範圍

13. 一種帶自鎖儲能裝置的螺栓，包括螺桿及螺母，其中，還包括一嗑合於螺桿外徑上的儲能簧，儲能簧中包含具有自鎖作用的內鎖簧及具有推力作用的外扭簧，螺母的上端面設有一個用於插植外扭簧端部的盲孔。

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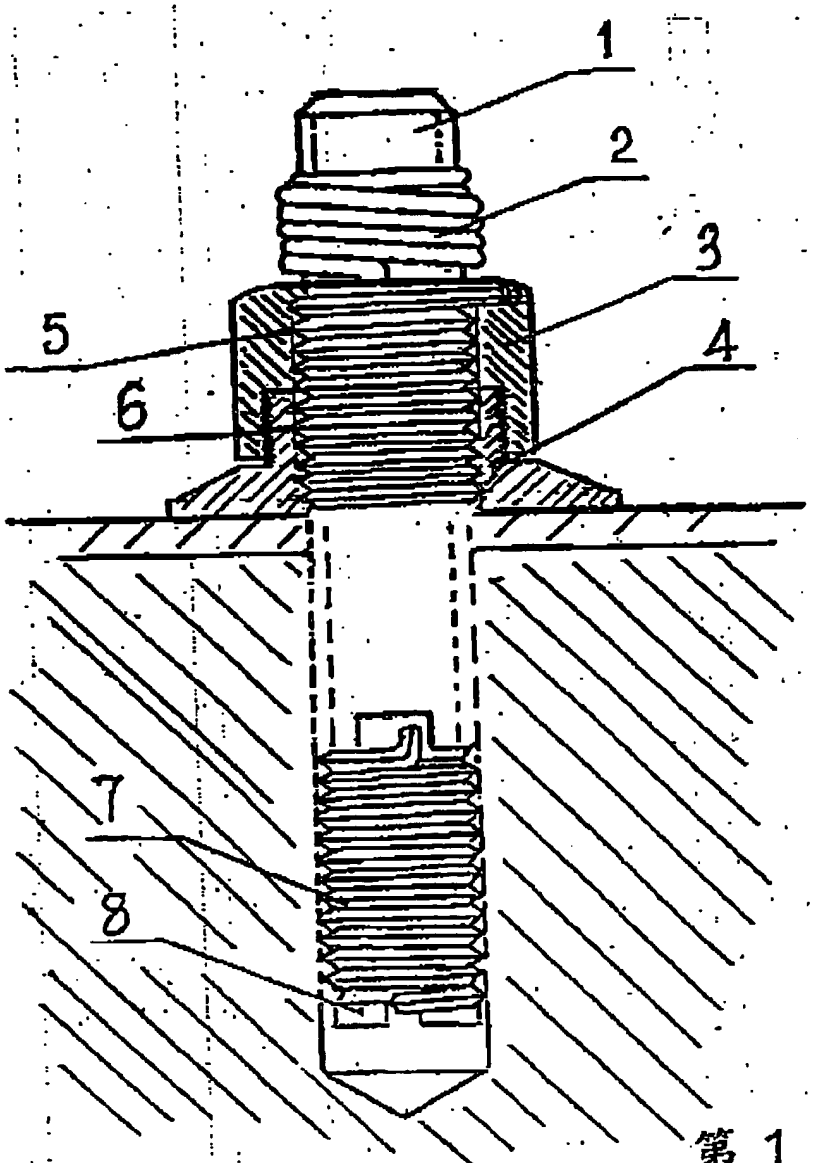
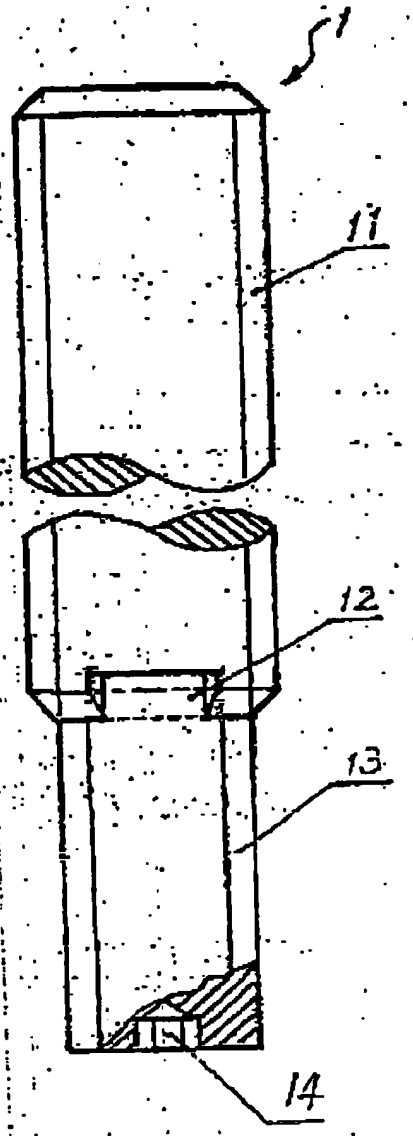


第 1 圖



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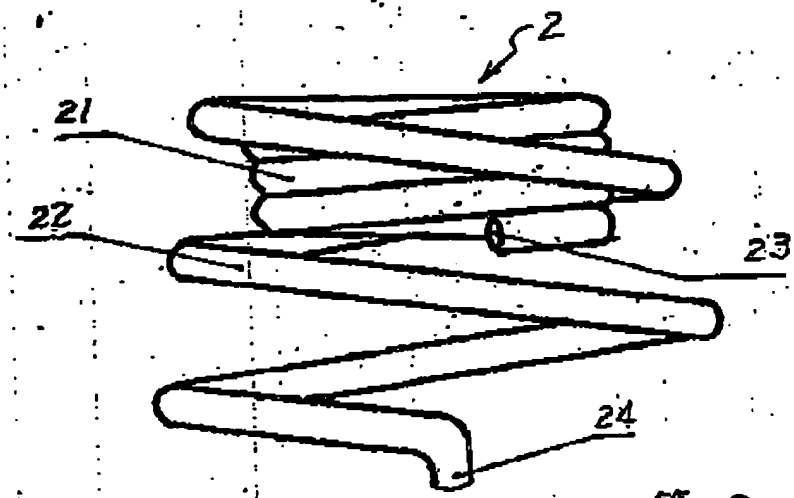

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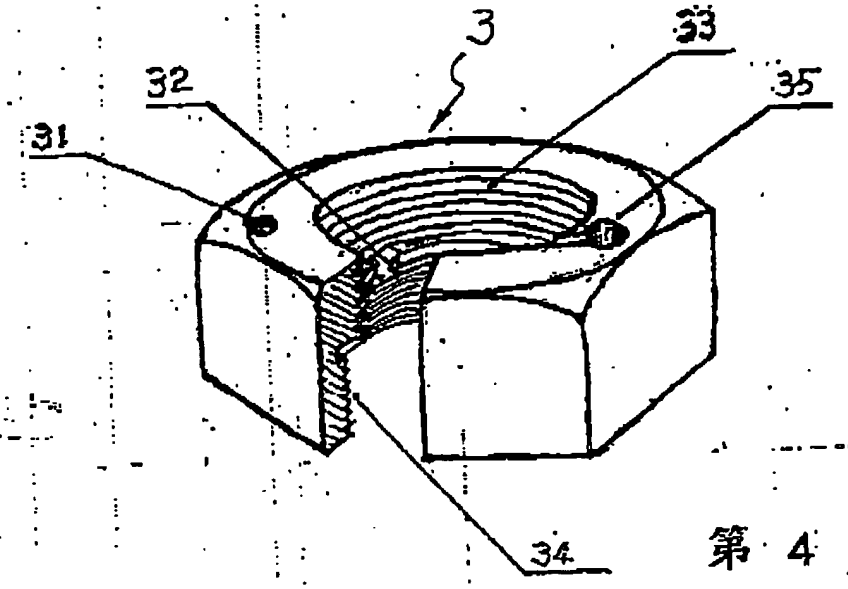

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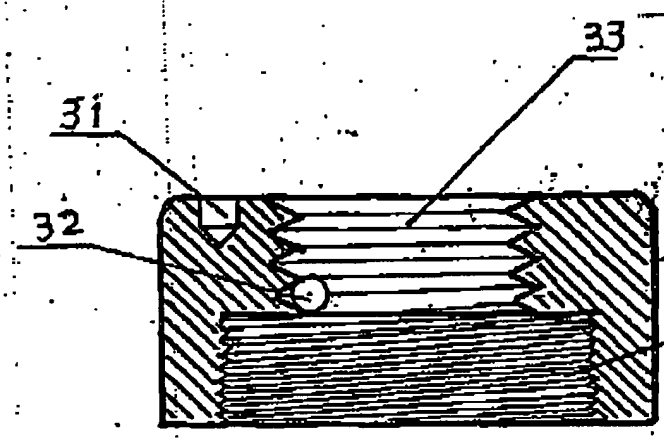

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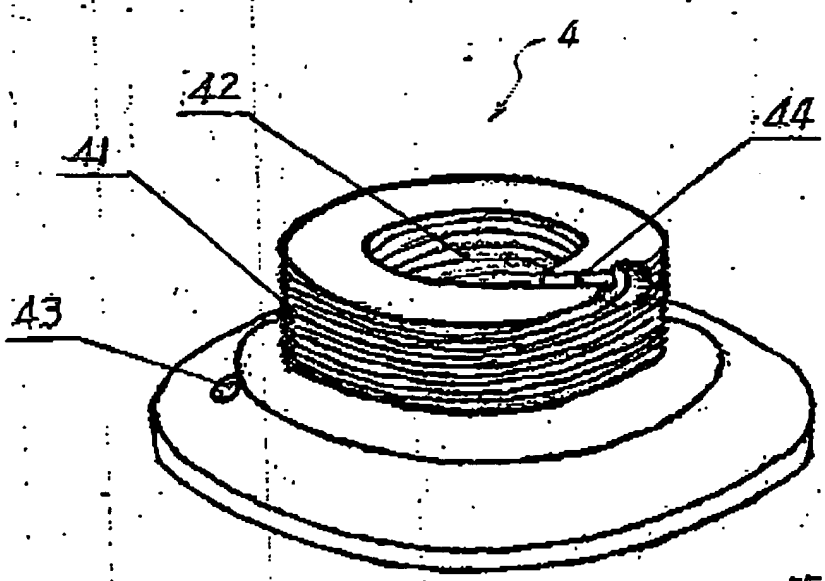

第 6 圖

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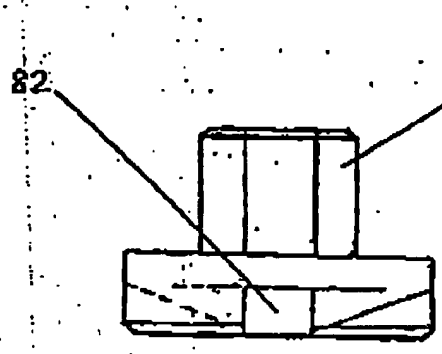

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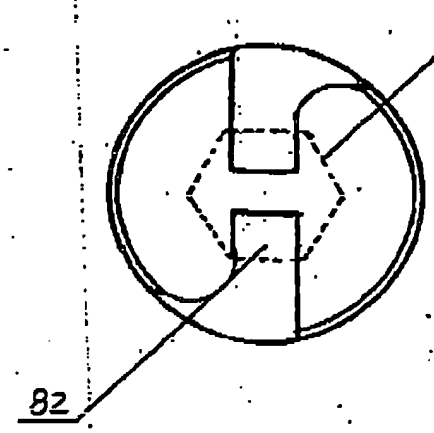

第 8 圖

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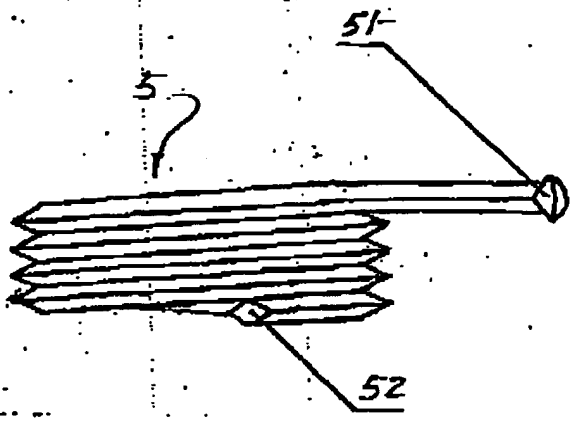
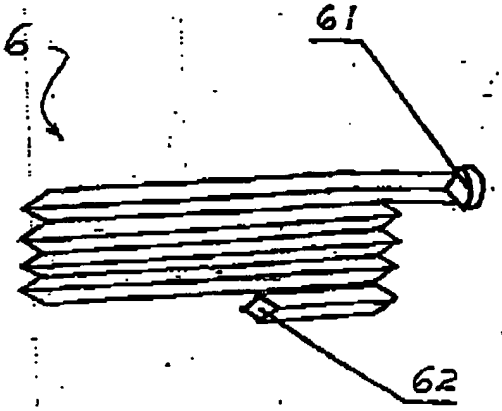
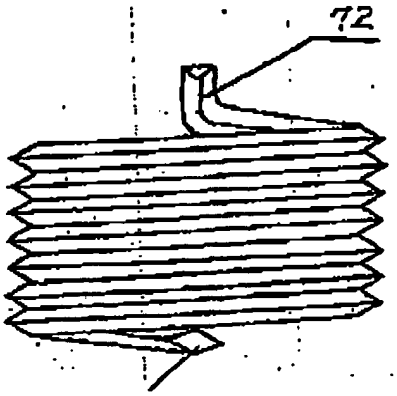


第9a圖



第9b圖



第9c圖

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